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NOTES ON GENERA *ALLOSTOMACHICOLA* YAMAGUTI, 1958, *STOMACHICOLA* YAMAGUTI, 1934 AND *ATHERIA* HAFEEZULIAH, 1975 (DIGENEA : HEMIURIDAE) FROM MARINE FISHES OF INDIA

M. HAFEEZULLAH

Zoological Survey of India, Calcutta

ABSTRACT

Detailed discussions on the terminal genital ducts of the type species of three genera, *viz.*, *Allostomachicola* Yamaguti, 1958, *Stomachicola* Yamaguti, 1934 and *Atheria* Hafeezullah, 1975 have been furnished in view of some observations made by Gibson and Bray (1979) in respect of them. *Linguastomachicola* Srivastava and Sahai, 1978 is considered as a synonym of *Stomachicola* Yamaguti, 1934, and *Stomachicola pelamysi* Gupta, R. C. and Gupta, S. P., 1976 is considered conspecific with *S. muraenesocis* Yamaguti, 1934. The type species, *Allostomachicola secundus* (Srivastava, 1939) Yamaguti, 1958, is redescribed in view of new facts making explicitly clear that *Allostomachicola* is sound and valid as against *Stomachicola*, and thus disagreeing with Verma (1973), Gupta, R. C. and Gupta, S. P (1976) and Gupta, V. and Ahmad (1978). Consequently, *S. rauschi* Gupta, V. and Ahmad, 1978 from the fish *Chirocentrus dorab* is considered as a synonym of *A. secundus*, and *S. singhi* Gupta, V. and Ahmad, 1978 from the fish *Acanthurus triostegus* as a synonym of *S. muraenesocis*. *Atheria* Hafeezullah, 1975 is discussed at length *vis-a-vis Erilepturus* Woolcock, 1935 and *Uterovesiculurus* Skrijabin and Guschaskaja, 1954.

INTRODUCTION

The present study has been prompted by Gibson and Bray's (1979) monograph, a study of which reveals that some inaccuracies in the literature about certain hemiurid genera genereally oecurring in Indian seas remain, causing confusion to workers. An attempt has been made here to dispel such confusions, to remedy the errors and to correct the records in the literature.

The material on which this paper is based was collected from various places along the west and east coasts of India. The specimens were first kept in normal saline till relaxed, killed in AFA under cover glass using additional pressure with the tip of a needle, dehydrated in grades of alcohol, stained with Borax Carmine, and mounted in Canada balsam. The specimens have been deposited with the Zoological Survey of India, Calcutta. All the measurements are in microns unless otherwise stated. Drawings have been made with the aid of a camera lucida. Scientific and English names of host fishes have been used according to Chan, Chan and Bathia, Chan & Talbot, Langham Nielsen, and Whitehead (1974) in FAO Species Identification Sheets for Fishery Purposes.

The author has already indicated largely through illustrations in his paper (1980) that *Allostomachicola* Yamaguti, 1958 is distinct from *Stomachicola* Yamaguti 1934 in the details of terminal genital ducts and the

associated structures, position of seminal vesicle with respect to the acetabulum, position and extent of pars prostatica, and lobed and unlobed nature of the ovary. In the light of these differences, he has disagreed with Verma (1973) who maintained that the two genera are congeneric. By the same reasoning, he also disagreed with Gupta, R. C. and Gupta, S. P. (1976) and Gupta, V. & Ahmad (1978) for considering *Allostomachicola secundus* (Srivastava, 1939) in the genus *Stomachicola*. When the manuscript of the author's paper (1980) was sent to press, Gibson & Bray's (1979) remarkable study on the superfamily Hemiuroidea Looss, 1989 had not appeared. They have pointed out that *Stomachicola lepturusi* Gupta, R. C. & Gupta, S. P., 1976 described on the basis of a single specimen recovered from the larval eel *Uroconger lepturus* appears to belong to *Allostomachicola*. Apparently, they have given credence to the pattern of terminal genitalia and the preacetabular position of the seminal vesicle. It seems that this species has not been adequately studied and described in respect of terminal genitalia, number of vitalline tubules and lobation of the ovary due to lack of sufficient material. In *Allostomachicola* the nature of vitelline tubules is such that the tubules of each side (4 on right and 3 on left) get closely intertwined and after pressing during processing give the appearnce of only one tubule on each side. Probably this had happened with the material of Srivastava (1939) collected from the fish *Hemiramphus limbatus*, but when Chauhan (1954) restudied a para/ topotype he discovered that the specimen did have 7 vitelline tubules. Similarly, lobation gets obliterated when the lobes overlap and the specimen is ltoo heavily squashed as might have happened in Gupta and Gupta's (1976) single specimen. Their material, however, needs rechecking. Mamaev (1970) reported *A. secundus* from the fish host *Chirocentrus dorab* in the South China Sea. *Stomachicola rauschi* Gupta and Ahmad, 1978 from *Chirocentrus dorab* in the Bay of Bengal is a synonym of *A. secundus*, and *Stomachicola singhi* Gupta and Ahmad, 1978 from the fish *Acanthurus triostegus* in the Bay of Bengal is a synonym *S. muraenesocis*.

Systematic Account

While defining *Allostomachicola*, Gibson and Bray (1979) chose to include "permanent sinus organ apparently absent. Ovary renifrom ; may be indistinctly lobed". The fact is that a well developed permanent sinus organ is easily detectable even in the young adults as has been shown by the author (1980, Fig. 2). The ovary is distinctly lobed even in immature specimens as shown in Fig. 2 of the present paper. The late Dr. H. W. Manter was once consulted in connection with the specimens having a well developed, sometimes coiled, sinus organ in a thin-walled tumbler-shaped genital atrium, which the present author had identified as *Allostomachicola secundus*. He had strongly suggested the erection of a new genus for such specimens distinct from *Allostomachicola* on this basis only. But in view of Chauhan's (1954) restudy of the para / topotype of *A. secundus*, the author still maintains that such specimens are nothing but *A. secundus*. The detailed shortcomings of the original description by Srivastava (1939) and restudy by Chauhan (1954) are as follows :

Srivastava (1939) did not show the details of terminal genital ducts with the original description of *Stomachicola secundus*. He showed it to be a very short duct. Chauhan (1954) showed in some detail the anterior genitalia in his fig. 13(b) and gonads in fig. 12(c), but he missed the muscular sinus organ lying in the large tumbler-shaped genital atrium. However, a somewhat coiled hermaphroditic duct within the sinus sac and the vitelline tubules 7 instead of two were shown. In the original desceiption the absence of a seminal receptacle has been mentioned but Chauhan (1954) detected its presence. In the opinion of the author Juel's organ is present. On the whole, it largely agrees with the combined descriptions and illustrations of Srivrstava (1939) and Chauhan (1954) except mainly the sttucture of the sinus organ. The author has not been able to examine the holotype or paratype of *A. secundus*, but neveretheless he is inclined to believe that the present material represents *A. secundus*. The confusion about certain structures in this species and ihe new facts about it necessitate its redescription which is provided below :

Allostomachicola secundus (Srivastava, 1939) Yamaguti, 1958

Syn. *Stomachicola rauschi* Gupta, V. and Ahmad, 1978 n. syn. (Figs. 1, 2)

Host : *Chirocentrus dorab* (Forskal), Dorab wolf herring, (Pisces : Chirocentridae)

Location : Stomach

Number of specimens : 2 mature from Bombay (Arabian Sea), collected by Prof. Ather H. Siddiqi of AMU, Aligarh in May, 1963; 1 young adult from Ennore (Bay of Bengal), collected in March, 1975 ; 1 still young from Pondicherry (Bay of Bengal), collected in December 1975 ; 1 immature specimen ftom Visakhapatnam (Bay of Bengal), collected in January, 1966.

Specimens deposited : Z.S.I. Reg. Nos. W 7477/1 to W 7481/1. Description (based on 5 specimens but with measurements on 2 fully mature ones) : Body proper 5.296-7.954 mm long, 1.147-1.498 mm wide at acetabular level, subcylindrical, muscular ; ecsoma 7.114-11.408 mm long, 0.675-1.39 mm wide. Tegument smooth, thick, slight denticulations at places on body proper due to contraction ; tegument of ecsoma smooth ; body plications absent. Acetabulum 931-1242 in diameter, spherical, at 972-1674 from anterior end of body. Oral sucker 495-688 in diameter, spherical, subterminal. Sucker ratio 1 : 1.85-2.0. Pharynx 297-418 long, 255-351 wide, oval. slightly overlapped by oral sucker ; oesophagus short, followed by 'Drüsenamagen' ; caeca forming shoulder, ascending a little anteriorly after bifurcation and then descending into posterior part of body, extending up to posterior end of ecsoma, at places winding ; internal wall of caecum thrown into raised spiral coils.

Testes 445-637, entire, diagonal, globular or oval, immediately posterior to acetabulum. Seminal vesicle 513-876, by 108-256, elongate

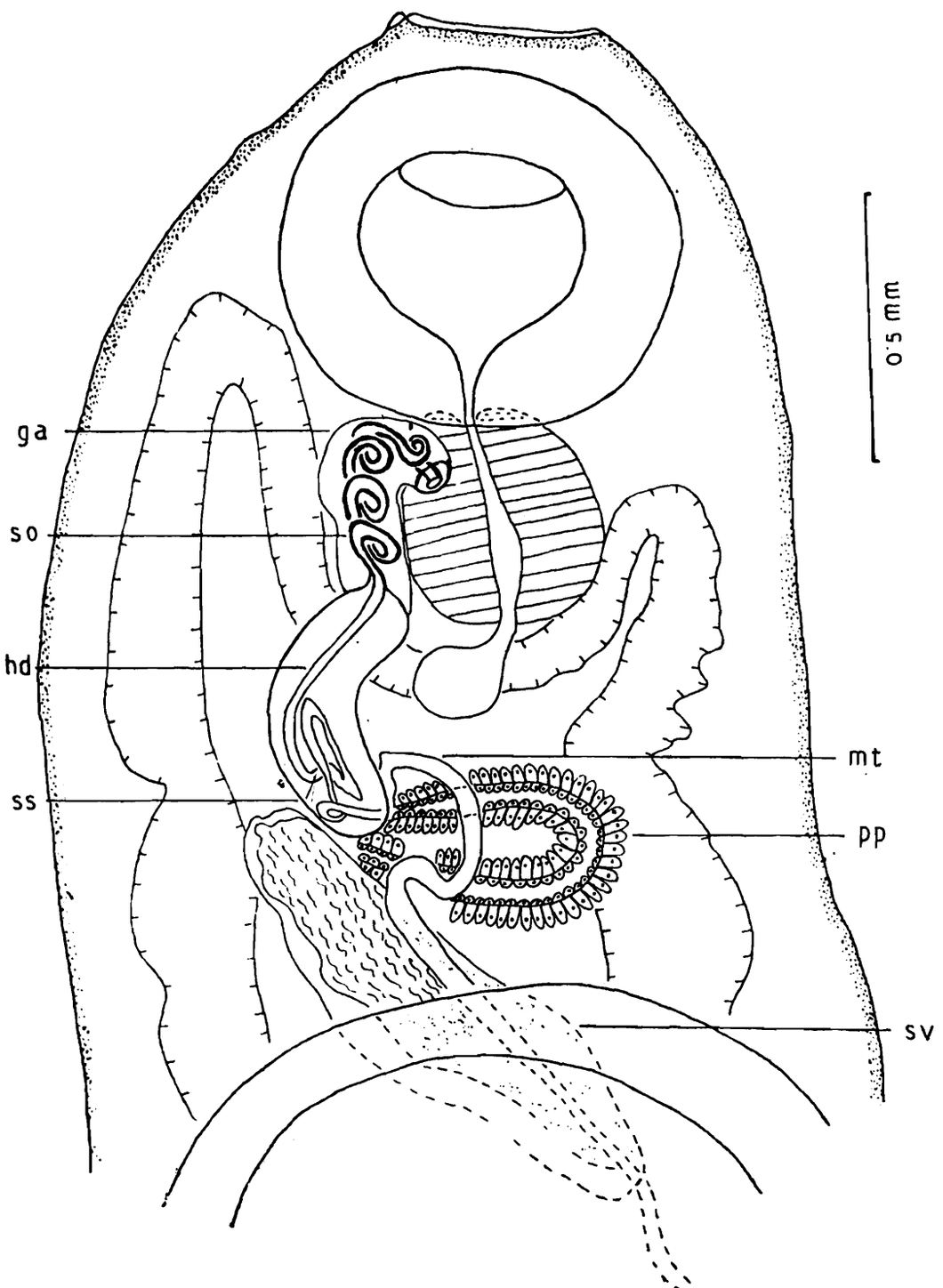

Fig. 1. Forebody of *Allostomachicola secundus* showing details of terminal genital ducts.

oval, thin-walled, straight, dorsal or antero-dorsal to acetabulum ; pars prostatica well developed, highly muscular, curved, surrounded by well developed prostate cells, connected to seminal vesicle by a short aglandular duct ; sinus sac elongate with thin muscular wall, enclosing long, narrow, coiled hermaphroditic duct forming into a long, wide, highly muscular, much coiled (may be straight in young adult specimens) permanent sinus organ, usually lying into long, thin-walled, tubular genital atrium. Genital pore ventral to base of oral sucker to anterior part of pharynx.

Ovary 432-607 by 351-486, distinctly four-lobed, (lobes separate and joined only in centre even in immature specimens (Fig. 3), post-acetabular, post-testicular, median. Fully developed. Juel's organ present immediately posterior to ovary. Uterine seminal receptacle also formed near oviduct immediately posterior to Juel's organ. Vitelline tubules 7, 4 on right and 3 on left, very long, narrow, much convoluted, sometimes interwined closely and tightly, some extending anterior while others posterior to ovary, sometimes descending into ecsoma also. Intricate coils of uterus mosly intercaecal, median, descending

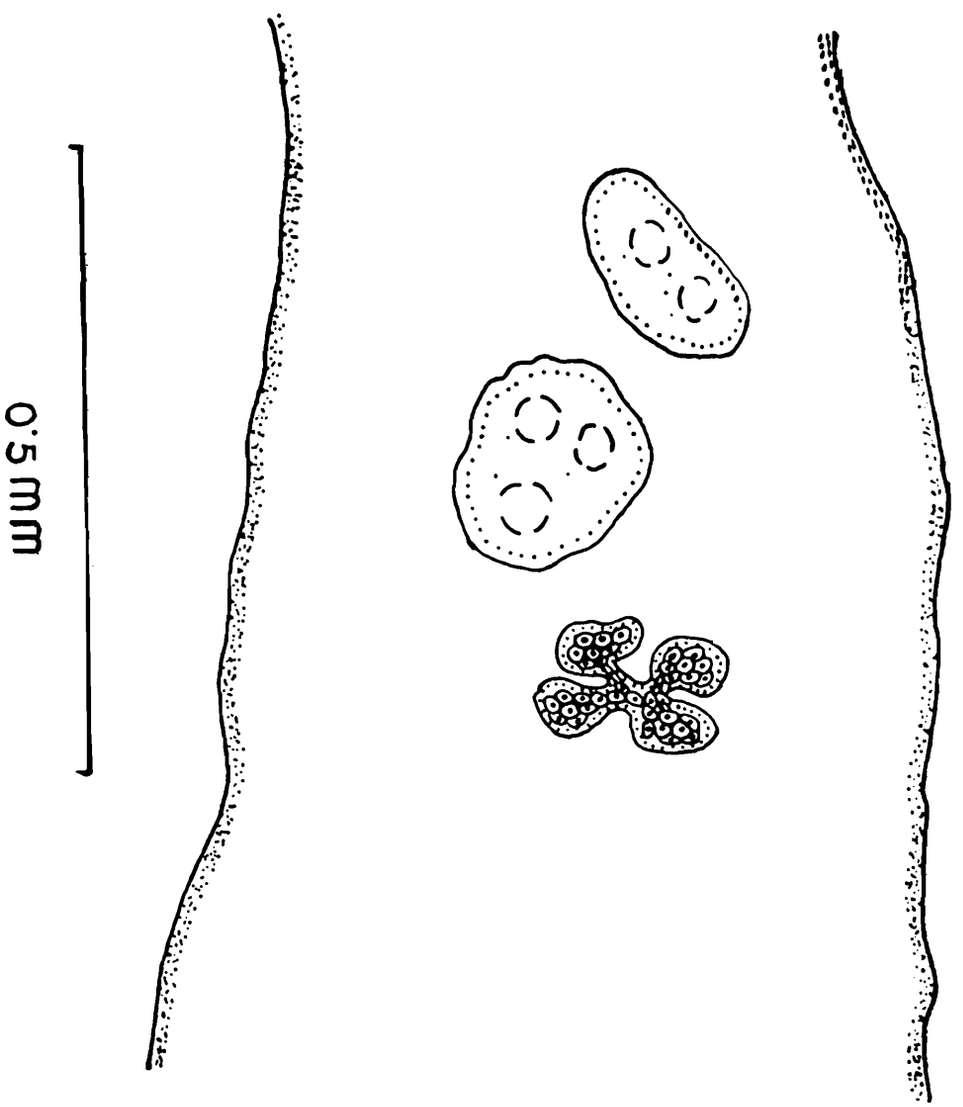

Fig. 2. Anterior part of hindbody of an immature specimen of *A. secundus* showing lobed ovary.

into ecsoma to varying extents. Metraterm differentiated, uniting with anterior end of pars prostatica at base of sinus sac to form hermaphroditic duct. Eggs 14-19 by 7-8. Excretory vesicle Y-shaped, arms uniting dorsal to oral sucker : excretory pore terminal.

It is to be noted that Srivastava (1939) collected the specimens of *A. secundus* from *Hemiramphus limbatus* Cuv. & Val., but the present author collected only from *Chirocentrus dorab* from the Arabian Sea and the Bay of Bengal, although almost all the species of *Hemiramphus* occurring along the west and east coasts of India were examined.

Thus, the diagnosis of *Allostomachicola* Yamaguti, 1958 should include the presence of a permanent sinus organ and distinctly lobed ovaty.

Stomachicola Yamaguti, 1934

Syn. *Pseudostomochicola* Skrjabin and Guschanskaja, 1954
Acerointestinecola Jehan, 1970
Cameronia Bilquees, 1971
Segmentatum Bilqees, 1971
Cestodera Bilqees, 1971
Indostomachicola Gupta and Sharma, 1973
Linguastomachicola Srivastava and Sahai, 1978 n. syn.

Stomachicola muraenesocis Yamaguti, 1934

(Fig. 3)

Syn. *Pseudostomachicola rubea* (Linton, 1910)
P. magna (Manter, 1931)
Acerointestinecola karachiensis Jahan, 1970
Cameronia octovitellarii Bilquees, 1971
C. pakistani Bilquees, 1971
Segmentatum karachiensis Bilqees, 1971
S. qadrii Bilqees, 1971
S. cinerensis Bilqees, 1971
S. magnaesophagustum Bilqees, 1971
Cestodera gastrocecus Bilqees, 1971
C. unicecus Bilqees, 1971
Indostomachicola kinnei Gupta and Sharma, 1973
Stomachicola mastacembeli Verma, 1973
Stomachicola pelamysi Gupta and Gupta, 1976
Stomachicola chauhani Pandey and Tiwari, 1984 n. syn.
Linguastomachicola serpentina Srivastava and Sahai, 1978 n. syn.

Hosts and localities : *Congresox talabonoides* (Bleeker), Indian pike-conger, (Pisces : Muraenesocidae)

Syn. : *Muraenesox talabonoides* (Bleeker) ; examined at Bombay (Arabian Sea) by Prof. Ather H. Siddiqi of AMU, Aligarh in May, 1963 ; *Muraenesox cinereus* (Forskàl), Daggertooth pike-conger, (Pisces : Muraenesocidae) ; examined at Veraval and Kandla (Arabian Sea), Chandipur, Machilipatnam, Kakinada and Yanam (Bay of Bengal) in May, 1965, November, 1978,

May 1972, and January-February 1975 respectively.

Location : Stomach

No. of specimens : 2+2+1+3+2+9+1 from respective localities, on 15 slides.

Specimens deposited : Z. S. I. Reg. Nos. W 7482/1 to W 7496/1

This is the type species of the genus *Stomachicola* Yamaguti, 1934. It has smooth body surface ; postacetabular seminal vesicle ; enormously long, winding, tubular pars prostatica connected to seminal vesicle by a short aglandular duct surrounded by well developed prostatic gland cells becoming less developed on only a short distal part a short hermaphroditic duct in a short sinus sac near pharyns ; sinus organ not distinct, may be rudimentary, in several specimens of this species the author has examined so far the formation of distinct sinus organ was not detected ; and an unlobed reniform or oval ovary. The so-called seminal receptacle just

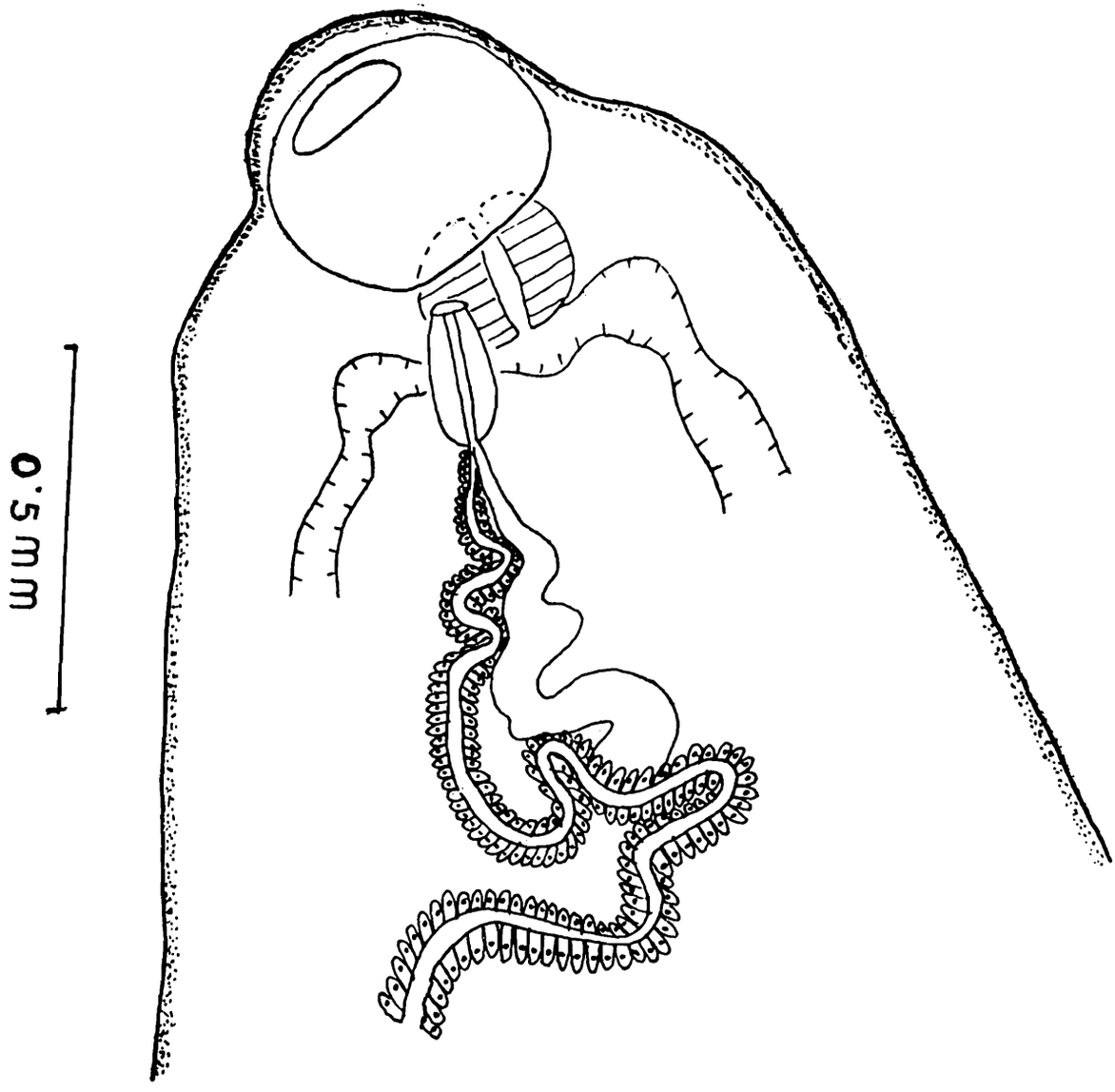

Fig. 3. Forebody of *Stomachicola muraenesocis* showing details of terminal genital ducts.

adjacent to the ovary posteriorly is probably 'Juel's organ' Vitelline reservoir located between ovary and 'Juel's organ ; vitellaria 7, very long winding (not intertwining) tubules descending into ecsoma laterally to a great extent, one or two tubules ascending ; uterine coils close, descending into ecsoma to varying distances. The genital opening usually lies in the pharyngeal area or even behind it depending on state of contraction or relaxation at the time of fixation. Excretory arms are united dorsal to oral sucker.

Stomachicola pelamysi Gupta, R. C. and Gupta, S. P., 1976, has been reported from the tuna, *Pelamys chilensis*, from Quilon, Arabian Sea. It has been described on the basis of only one specimen, and differentiated from the type species *S. muraenesocis* in two characters only ; the genital opening behind caecal bifurcation and diagonal testes. As these characters show up in some badly preserved specimen of the type species also, *S. pelamysi* is considered nothing but *S. muraenesocis*. *Linguastomachicola* Srivastava and Sahai (1978) from the eel *Muraenesox talabonoides* from the Arabian Sea, is based on a tongue-like structure associated with the oral sucker. This structure is almost certainly an artifact. Thus, *Linguastomachicola* is considered congeneric with *Stomachicola*, and *L. serpentina* Srivastava and Sahai, 1978 conspecific with *S. muraenesocis*. Pandey and Tiwari (1984) described *Stomachicola chauhani* in the fish *Formio* sp. from Bombay coast. This species has been differentiated from the type in the position of genital pore only, which character is considered as variation only. Therefore this also falls a synonym of the type species, *S. muraenesocis*.

Atheria Hafeezullah, 1975

Atheria zakiae Hafeezullah, 1975

(Fig. 4)

Hosts and localities : *Pomadaysis hasta* (Bloch), lined silver grunt, (Pisces : Pomadaysidae), from Visakhapatnam (Bay of Bengal) ; examined in October 1964 ; *Johnius carutta* Bloch, karut croaker, (Pisces ; Sciaenidae), from Madras (Bay of Bengal) ; examined in November 1964 ; *Sillago sihama* (Forskål), silver sillago, (Pisces : Sillaginidae), from Puri (Bay of Bengal) ; examined in June 1972 ; *Therapon jarbua* (Forskål). jarbua therapon, (Pisces : Theraponidae), from Gopalpur (Bay of Bengal) ; examined in November 1973.

Location : Stomach

No. of specimens : 2+1+1+1 from respective localities, on 5 slides.

Specimens deposited : Z. S. I. Reg. Nos. W7497/1 to W7501/1

Gibson and Bray's (1979) views made the author re-examine the material of this species. Certain discrepancies inadvertently occurred in the original description of this species in respect of the hermaphroditic duct and the genital atrium as well as the true nature of the seminal receptacle. The terminal part of uterus is differentiated as a

metraterm which is highly muscular and a part of it swollen as a side outpocket. The metraterm then continues as a tube to join the pars prostatica to form a short hermaphroditic duct enclosed in a sinus sac. The hermaphroditic duct ultimately enters a sinus organ lying in a tubular genital atrium. The sinus sac and the genital atrium jointly give the appearance of a barrel-shaped structure. In all the five specimens the nature of the seminal receptacle is (as against original report) that there is an isolated globular mass of sperm cells surrounded by a muscular wall behind the ovary and very near to the Mehlis' gland complex and that it is not like the one present in *S. muraenesocis*, *A. secundus* and *Uterovesiculurus* spp. It is connected to the ovary by a short duct. In one specimen it is lying anterior to the ovary. By all possibilities and at best it can be called 'blind seminal receptacle'. Moreover, there is no indication of the formation of uterine seminal receptacle in this species. Unfortunately there is no additional material for serial sectioning.

Hafeezullah (1975) proposed *Atheria*. It was compared with and distinguished from the closely allied genera *Erilepturus* Woolcock,

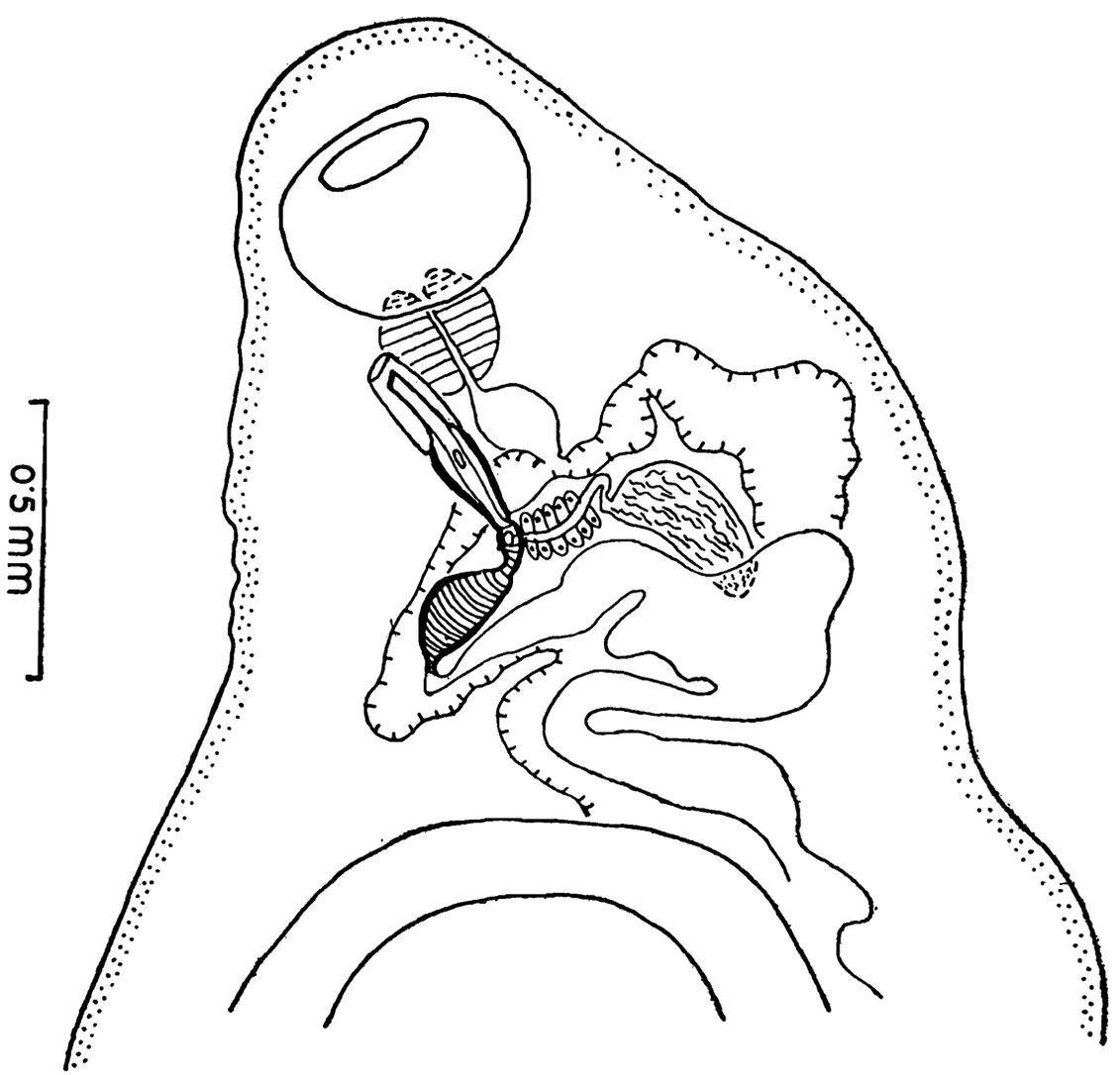

Fig. 4. Forebody of *Atheria zakiae* showing details of terminal genital ducts.

1935 and *Uterovesiculurus* Skrjabin and Guschankaja, 1954. In view of the opinion of Gibson & Bray (1979), it may be added that the gulf of difference between the terminal uterine swelling in the genera *Uterovesiculurus* and *Atheria* is quite wide. In the former the swelling is vesicular, its wall being as thin as that of uterus itself and abruptly joins the male duct whereas in the latter a fairly large portion of the uterus is differentiated as a highly muscular metraterm initially with the muscular swelling as a side outpocket and later again continues as a tube before it joins the male duct to form the hermaphroditic duct. In *Uterovesiculurus* and *Erilepturus*, probably 'Juel's organ' is present and there is a distinct tendency for the formation of uterine seminal receptacle whereas in *Atheria* the 'Juel's organs' is not present and the tendency for the formation of uterine seminal receptacle is lacking. It may also be emphasised that the shortening of the length of the aglandular part of the pars prostatica is associated with the preacetabular position of seminal vesicle. The tubular shape of the base of sinus sac in *Atheria* as compared to the swollen base of this structure in *Uterovesiculurus* and *Erilepturus* is another character which can be used to distinguish the former from the latter.

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ABBREVIATIONS

ga : genital atrium
hm : hermaphroditic duct
pp : pars prostatica
so : sinus organ
ss : sinus sac
sv : seminal vesicle
ut : uterus